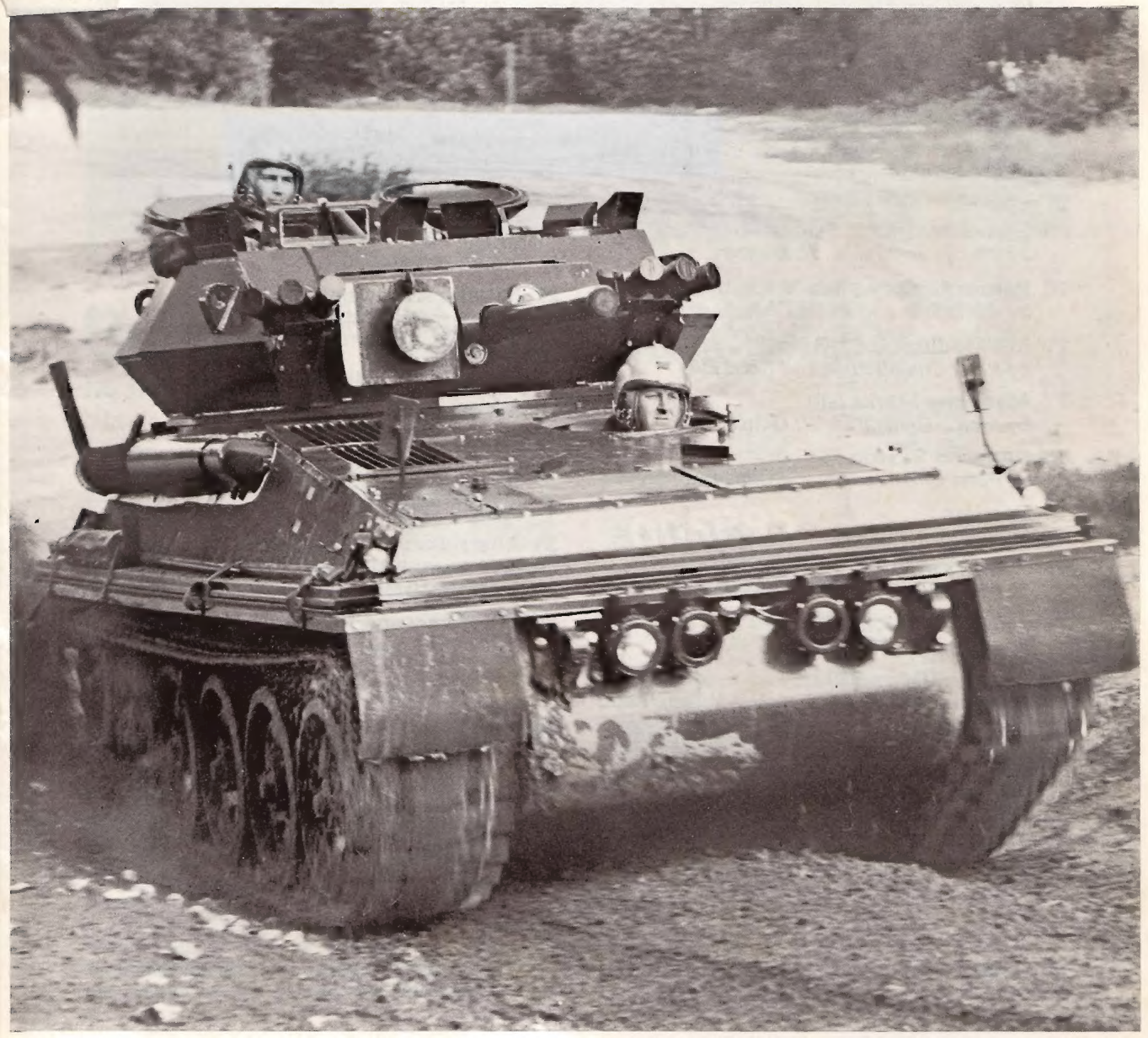
PROFILE

AFV WEAPONS

34

Scorpion Reconnaissance Tank

by R. M. Ogorkiewicz



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Prototype of Scorpion Combat Vehicle, Reconnaissance, Tracked. (Alvis)

Scorpion Reconnaissance Tank

by R.M. Ogorkiewicz

LIGHT tanks and other tracked vehicles built mainly for reconnaissance purposes have been the least successful type of armoured equipment. The larger vehicles have resembled battle tanks but have lacked any significant advantage over them to compensate for their inferior fighting capabilities. The smaller vehicles have enjoyed the advantages of light weight but most have been poorly armed and many have only served to carry two or three men around.

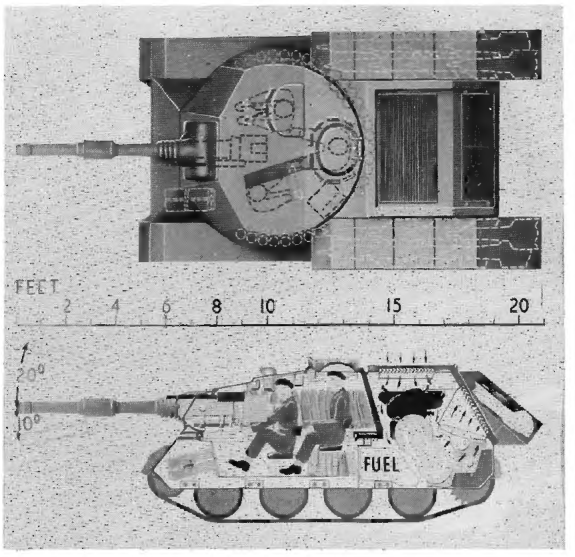
The shortcomings of tracked reconnaissance vehicles have been due largely to failures to recognise the two cardinal requirements which they must fulfill to justify their development. First, they must be significantly more mobile than battle tanks: if they can not be more mobile they are not worth having since battle tanks are bound to be superior in every other respect. Secondly, they must be sufficiently well armed not to be prevented from carrying out their reconnaissance tasks by light opposition and to be able to perform the counter-reconnaissance and security roles normally entrusted to armoured reconnaissance units.

The two requirements are to some extent conflicting and they are not, therefore, easy to meet in one vehicle. Nevertheless, they have been successfully met in at least one recent vehicle, the Scorpion developed by the Military Vehicles and Engineering Establishment and produced by Alvis Limited.

ARMOURED VEHICLE, RECONNAISSANCE

The successful development of the Scorpion stems from the recognition by the British Army around 1960 of the need for a successor to the Saladin armoured car which by then had become its principal armoured reconnaissance vehicle. What was envisaged was a sophisticated vehicle capable of performing several roles, including those of a tank destroyer, a fire support vehicle and a surveillance vehicle. This prompted a number of feasibility studies for what became known as the Armoured Vehicle, Reconnaissance or AVR.

Similar ideas prevailed at about the same time in the United States, leading to the design of the Armoured Reconnaissance/Airborne Assault Vehicle, or ARAAV, which has since become the M551 Sheridan. This is a relatively large, 15-tonnes tank which is armed with a 152mm combination gun and missile launcher but whose design is otherwise conventional. In contrast, the earliest design of the AVR evolved to a 1960 British



Drawing of the Armoured Vehicle, Reconnaissance, or AVR, proposed in 1960. (MVEE)

Army requirement by what was then the Fighting Vehicles Research and Development Establishment and now the Military Vehicles and Engineering Establishment was highly unconventional. Like the Sheridan, the AVR was to fire anti-tank guided missiles as well as high explosive shells but not from a gun/launcher, which inevitably involves compromises between the conflicting requirements of the two weapon systems. Instead, it was to have a 76 or 105mm gun and separately mounted Swingfire guided missiles. What is more, its gun and its crew of three, including the driver, were all located in a limited, 180 degree traverse turret at the front of the vehicle while the missiles were located in the rear section of the hull which was almost as high as the turret. This unusual arrangement was devised to keep the AVR compact in spite of the weapons it required to perform its different roles. Otherwise the 1960 design was intended to use the Rolls-Royce K.60 engine, Allison transmission and other components of the contemporary F.V.433, the 105mm Abbot self-propelled gun, and it was to weigh 13·6 tonnes.

The original requirements for the AVR very sensibly left open the question whether it was to be tracked or wheeled. Thus, another British Army requirement, issued in 1961, produced by the end of 1963 an alternative FVRDE design for a six-wheeled AVR. Its weight was to be comparable to that of the earlier tracked design and it was also to be armed with a gun and Swingfire guided missiles. However, its layout was more conventional, except that its automotive design was related to that of the TV 1000, a large six-wheeled test vehicle with skid steering.

Neither of the two alternatives ever advanced beyond the stage of feasibility studies because in 1963 they came to be regarded as too heavy, mainly from the point of view of air-transportability. At the same time the view was taken that a single vehicle should not be expected to perform all the roles envisaged for the AVR. This was in contrast to the attitude of the U.S. Army which went ahead with the development of the ARAAV. As a result a new requirement was issued in 1964 calling not for a single 13·6 tonnes AVR but for a family of vehicles weighing between 6 and 6·5 tonnes. The outcome of this were two new types of vehicles. One was the Combat Vehicle, Reconnaissance, Wheeled which has since become better known as the Fox armoured car. The other was the Combat Vehicle, Reconnaissance, Tracked, or CVR(T), which has become the Scorpion.

TV 15000

The new requirement for a light tracked reconnaissance vehicle was prompted by a feasibility study carried out in 1963–64 by the Concepts Section of FVRDE. This study advanced the idea of a family of light tracked vehicles weighing no more than about 5 tonnes. Possible members of the family included an interesting anti-tank vehicle with a turret-mounted 120mm Wombat recoilless gun and a turreted 76mm gun model, but the vehicle which it was thought should be developed first was a 105mm air-portable self-propelled gun, or gun carrier—since its gun could be dismounted as well as fired from it.

None of these vehicles were built but the study of them paved the way for further development which took the form of a test vehicle built by FVRDE. This, the TV 15000, clearly established the feasibility of a light, highly mobile tracked reconnaissance vehicle. It also demonstrated several design features which were later incorporated in the Scorpion. In particular, it introduced the configuration which was adopted for the Scorpion and aluminium armour which had not, until then, been used in any British tracked armoured vehicle.

Other features of the TV 15000 included a hydro-

Small-scale model of an anti-tank vehicle with a 120mm recoilless gun in a trunnion-mounted turret proposed in 1964 as part of a light-weight vehicle family (MVEE)

Small-scale model of a very light weight reconnaissance tank proposed in 1964 which clearly foreshadowed the Scorpion; one track has been left off this model. (MVEE)

Small-scale model of a light-weight 105mm self-propelled gun proposed in 1964, with gun in travelling position. (MVEE)

Small-scale model of the light-weight 105mm self-propelled gun with gun in firing position. (MVEE)

pneumatic suspension and a very light track with forged aluminium links. The light track was developed not only to help reduce the weight of the whole vehicle, of which tracks generally represent about 10 per cent, but also because track weight has an important influence on vehicle speed. A striking demonstration of this was provided during the trials of the TV 15000 when a change from a relatively heavy, conventional, cast steel track to a light-weight track increased its maximum speed from 48 km/hr to 77 km/hr.

When it was first built, in August 1964, the TV 15000 was powered by a Rolls-Royce B.60 six-cylinder spark-ignition engine with a gross output of 130 b.h.p. But in 1966 this engine was replaced by the much more powerful 4·2 litre Jaguar XK, which was coupled to a Rolls-Royce automatic gearbox and a controlled differential steering unit.

MOBILE TEST RIG

In the meantime, Britain joined Canada, Australia and the United States in supporting a contract given to the Ordnance Division of FMC Corporation, of San Jose, California, for a design study of a light reconnaissance vehicle which could be adopted by all four countries concerned. What the FMC design amounted to, however, was only a tracked scout carrier, a singularly ineffective type of vehicle but one favoured, nevertheless, by the U.S. Army. It was ironical therefore that it was rejected, in October 1966, by the U.S. Army. However, it was not rejected, as it should have been, because it was only a 3-man carrier in spite of its weight of 7 to 8 tonnes but because it was too heavy to be lifted by helicopter. After this the whole quadripartite project collapsed.

In contrast, the FVRDE project study which was pursued in parallel with the work on TV 15000 was approved by the British Army in August 1965. This made FVRDE proceed to the design of the CVR(T) and to the construction of two test rigs.

One of the rigs was static and consisted of the front section of the CVR(T) hull in which the engine could be installed to check the efficiency of the cooling system and various details of the engine compartment. The second rig was mobile. It amounted to, in effect, the chassis of the CVR(T) although it was called a Mobile Test Rig, or MTR. It was built to test the automotive features of the CVR(T) and in particular its suspension and transmission.

Evaluation of the hydro-pneumatic suspension installed in the TV 15000 had shown that it offered no major improvements in ride characteristics while it suffered from the disadvantages of being heavier and more expensive than the more conventional torsion bar type of suspension which was consequently adopted for the CVR(T). The transmission was also different from that of the TV 15000 which had a separate gearbox and steering unit, like most other light tracked vehicles. This meant that the transmission assembly was relatively long and made the engine protrude too far into the hull. As a result, Self Changing Gears Ltd. built a much more compact transmission which incorporated the steering mechanism within the gearbox, as in most modern battle tank transmissions. In fact, the TN-15 transmission developed for the CVR(T) and first tried in the MTR was a scaled down version of the Merritt-Wilson TN-12 transmission used in the Chieftain tank. In consequence, it was not only compact but also incorporated a triple differential steering system giving radii of turn which decrease as the gears are shifted down and a pivot turn in neutral. On both counts, therefore, the TN-15 transmission is greatly superior to the transmissions of most other contemporary light tracked vehicles with the less sophisticated controlled differential steering systems.

SCORPION PROTOTYPES

The construction of the MTR greatly facilitated the next stage in the development of CVR(T) which started in September 1967 when Alvis Ltd. were awarded a contract for designing it for production and building 17 prototypes. Alvis secured the contract in competition with other companies but they were particularly well qualified to work on the CVR(T) because of their successful development and production of its predecessor, the Saladin armoured car, and its derivatives.

The first prototype was completed by Alvis in January 1969, exactly as planned—a rare event in the development of armoured fighting vehicles which has been plagued with delays. Many of the delays have been caused by the pernicious tendency to constant modi-

TV 15000, a turretless test vehicle with instruments to record its performance (MVEE)

fications of designs and this, mercifully, was avoided in the development of the CVR(T). Fifteen more prototypes were built by Alvis within the following twelve months and the seventeenth a little later. By then the CVR(T) also became generally known as the Scorpion.

The effort which Alvis put into the design and construction of the Scorpion was rewarded in May 1970 when they received an order for the production of more than 2,000 vehicles for the British Army. A little later the Belgian Army also expressed its intention to procure a further 600 to 700 vehicles, to be produced under an Anglo-Belgian co-production agreement.

ALUMINIUM ARMOUR

One of the major problems in the development of the CVR(T) was the establishment of fabrication techniques appropriate to the aluminium alloy armour of which it was to be built. In principle the use of aluminium armour was not new, as it had already started in the United States with the M113 armoured personnel carrier which was put into production in 1959. However, the armour of the M113 and other contemporary aluminium armoured United States vehicles, such as the M114 reconnaissance vehicle and the M108 and M109 self-propelled guns, consisted of the original, 5083-type aluminium-magnesium-manganese alloy. This was relatively easy to weld but its areal density, that is weight per unit of area it protects, is virtually the same as that of steel armour.

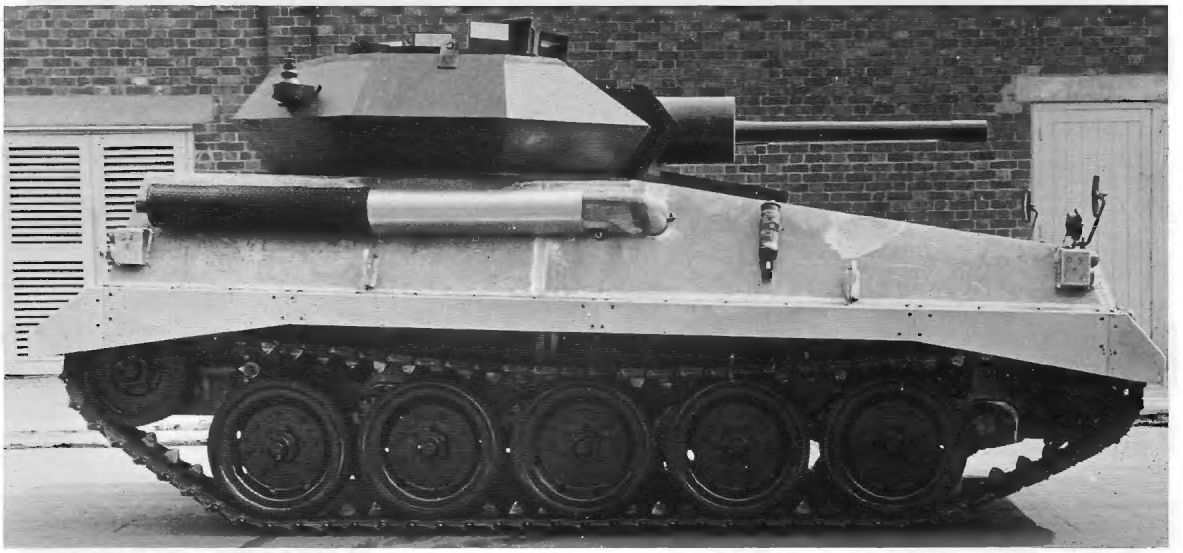
The CVR(T), on the other hand, was to be welded of the more recently developed aluminium-zinc-magnesium 7039-type of alloy which was heat treated and superior ballistically to the earlier 5083-type alloy. This meant that armour of the 7039 type was lighter, for a given level of protection, than either the 5083-type aluminium armour or steel armour. At the same time the 7039-type armour offered much the same structural advantages over steel armour as the earlier type of aluminium armour, because plates made of it were inevitably thicker and consequently stiffer than equivalent steel plates, which made it possible to dispense with many of the structural stiffeners necessary in light steel-armoured vehicles.

Experience with the 7039-type armour was, however, still very limited. In fact, when the CVR(T) was being designed the 7039-type aluminium armour had only been adopted for one vehicle, the U.S. M551 Sheridan, and only for the hull, the turret still being of steel armour. Thus, the decision to make the CVR(T) entirely of the new type of aluminium armour represented a major advance and as a result of it the Scorpion became the first tank in the world to have its turret, as well as its hull, welded from aluminium alloy armour.

AIR TRANSPORTABILITY

The weight savings resulting from the adoption of the 7039-type of aluminium armour were particularly important in the case of the Scorpion because of the importance which the British Army attached during its development to air transportability. This was closely connected with the contemporary withdrawals of British troops from various garrisons outside Europe and the idea that their place would be taken, when required, by units flown from the United Kingdom. That this should ever be done was highly questionable on both political

MTR, or Mobile Test Rig, in which the engine, transmission and other components of the Scorpion were tested prior to the construction of its prototypes (MVEE)



Side view of the MTR after the installation of a turret (MVEE)

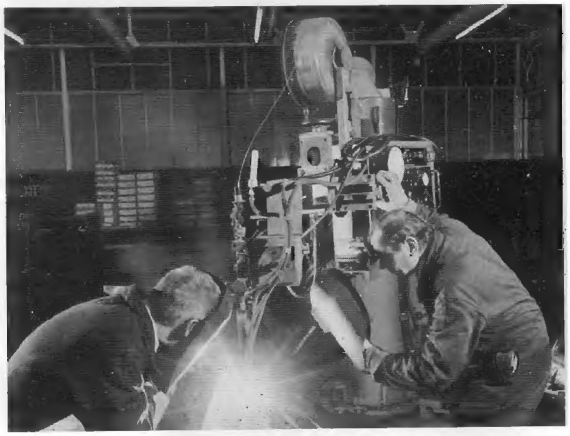
Scorpion lifted by a Sikorsky S-65 helicopter of the U.S. Marine Corps (Alvis)

The first prototype of the Scorpion completed on time by Alvis Ltd. on the 23rd January 1969. (Alvis)

An early photograph of a Scorpion Combat Vehicle, Reconnaissance, Tracked, or FV 101, in its prototype form. (Alvis)

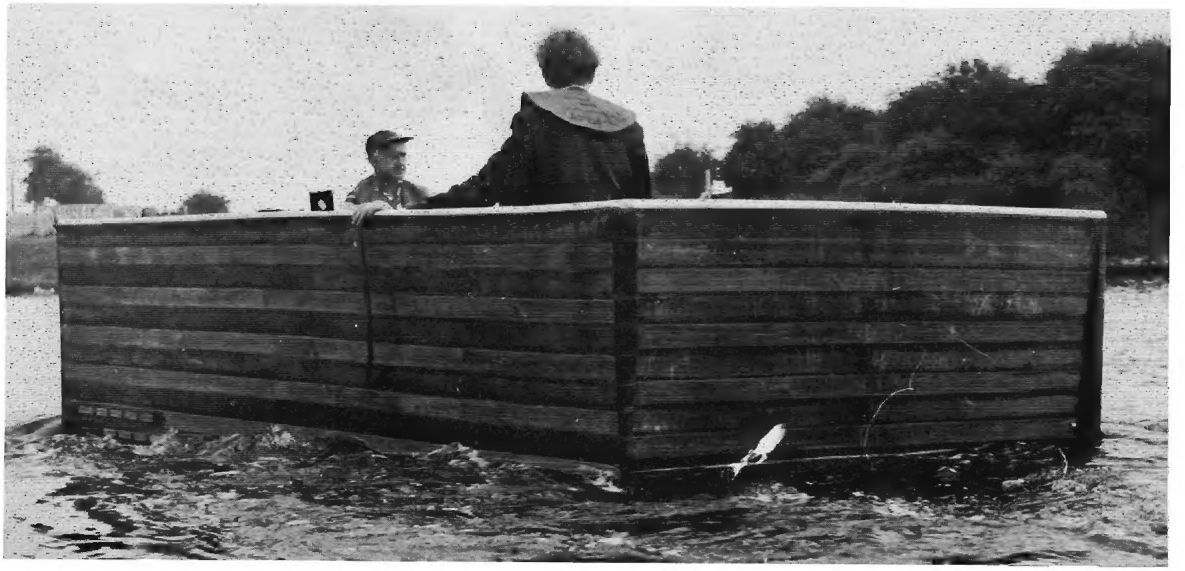
Scorpion prototype showing the undercut turret sides (Alvis)

Side view of a Scorpion prototype which illustrates the rear location of the turret (Alvis)



Welding the aluminium armour hull plates of the Scorpion (Alvis)

Scorpion prototype, showing the louvres over the engine compartment (Alvis)



Scorpion swimming with the aid of its collapsible flotation screen (MVEE)

and economic grounds and the idea of flying British troops about to police the world has since been largely abandoned but it served at least one useful purpose in keeping the weight of the Scorpion down to a minimum.

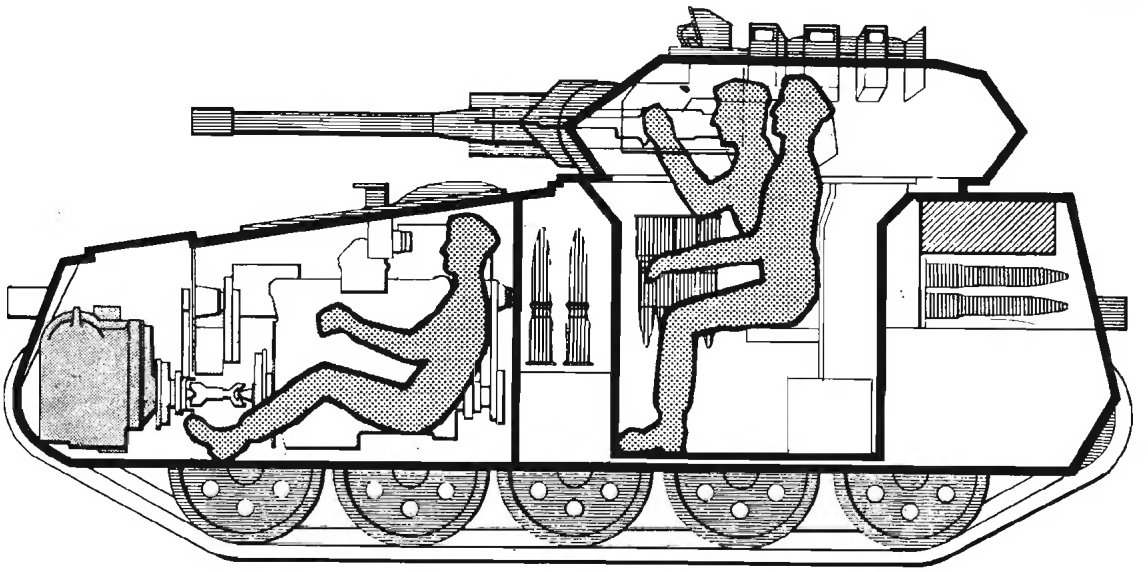
The weight of the CVR(T) was originally related to the carrying capacity of the projected HS 681 transport aircraft. Subsequently its weight was increased somewhat, the limit, fully laden, being set at 7·9 tonnes. However, even then two Scorpions could be carried in such military transport aircraft as the Lockheed C-130 Hercules, which was adopted by the Royal Air Force as well as being widely used by the U.S. Air Force.

Moreover, the Scorpion can even be lifted by helicopter. This was shown in 1970 when a Scorpion prototype was lifted by a Sikorsky S-65 heavy assault helicopter of the U.S. Marine Corps, which provided a striking demonstration of its light weight.

However, a much more practical result of the light weight of the Scorpion has been its low ground pressure. In fact, its light weight made it possible to reduce its nominal ground pressure to as little as 0·35 kg/cm². This is only half the ground pressure of the best of contemporary battle tanks and is considerably less even than that of other light armoured vehicles, including light tanks such as the M551 Sheridan. In consequence the Scorpion can move over soft ground impassable to other armoured vehicles and difficult even for men to cross on foot.

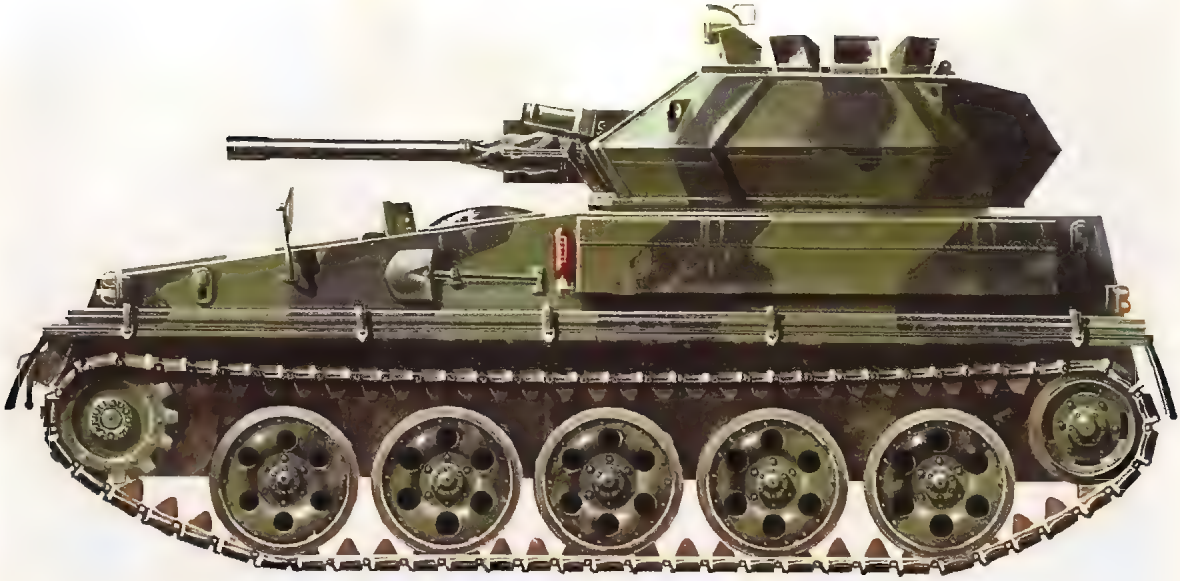
The low ground pressure of the Scorpion is all the more praiseworthy as it was achieved within the confines of very compact overall dimensions. A limit of 2·1 m was actually imposed on its overall width to enable it, among other things, to pass between the trees of Malayan rubber plantations and along narrow cart tracks. This, in turn, virtually determined its overall length, because the ratio of the length of the tracks on the ground to the

Cross-section of the Scorpion showing the location of the crew and its principal components (Alvis)



Scorpion demonstrating its ability to move even through deep mud (Alvis)

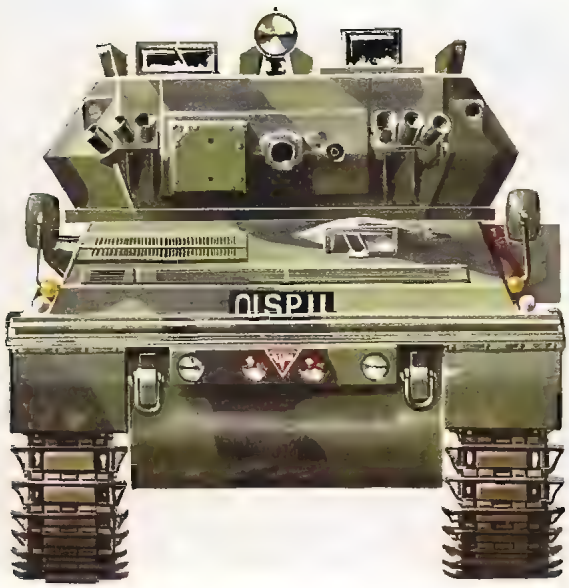
Rear view of a Scorpion prototype which had just crossed an area of deep mud (Alvis)



Above and below: Side and front views of Scorpion Combat Vehicle, Reconnaissance, Tracked, FV 101. Note rear location of its turret.

Right, above: Scorpion in its pre-production form. Scorpion has crew of three and 76mm main armament.

Right, below: Spartan armoured personnel carrier prototype. Spartan carries seven men—commander, gunner, driver and four riflemen.

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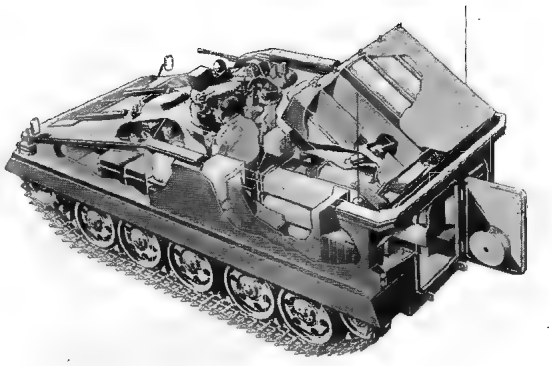
A Scorpion prototype moving at speed (Alvis)

Camouflaged Scorpion during troop trials (British Army)

Pre-production version of the Scorpion moving at high speed during troop trials (British Army)

Three-quarter left front view of the Scorpion in its pre-production form (MVEE)

Three-quarter right front view of a fully equipped Scorpion in its pre-production form (MVEE)



Sectioned drawing of a Striker anti-tank guided weapon vehicle, or FV 102 (Alvis)

distance between track centre lines is fixed within narrow limits by steering considerations.

The height of the Scorpion is also commendably low. To the top of the turret roof it is only 1·9 m and even the overall height, to the top of the gunner's periscope, is only 2·1 m. This gives the Scorpion an exceptionally low silhouette and makes it a difficult target to hit.

Because of its compact dimensions, the Scorpion does not have sufficient buoyancy to float, unaided. It is nevertheless amphibious because it has been fitted with a collapsible flotation screen. The screen, which is relatively small as a result of the light weight of the Scorpion, can be erected by its crew in a few minutes and enables it to swim across inland water obstacles, propelling itself by means of its tracks at up to 7 km/hr. The flotation gear can be left off, of course, when the employment of the Scorpion does not call for an amphibious capability but in many areas the ability to swim across rivers or canals is very valuable, particularly for reconnaissance vehicles.

JAGUAR ENGINE

A major contribution to the compactness of the Scorpion was made by the judicious choice of its engine. This fell on the Jaguar XK which was first tried in the TV 15000 and whose installation was fully developed by FVRDE in the MTR as well as the static test rig. The XK engine was chosen because it offered high power-to-weight and power-to-volume ratios and also because it was a proved unit in commercial production which made it available at a reasonable price.

The Jaguar XK is an in-line 6-cylinder water-cooled spark-ignition engine with an aluminium cylinder block and head, an overhead camshaft and a total swept volume of 4·2 litres. In its high compression car version it develops 265 b.h.p. but in its militarised form it has been derated to 195 b.h.p., to enable it to run on low octane military grades of gasoline. However, even in its derated form it gives the Scorpion a power-to-weight ratio of 26 b.h.p. per tonne and a maximum road speed of 80 km/hr, both of which are well above those of most other tracked armoured vehicles.

In spite of all the advantages of the Jaguar engine, a second, alternative engine installation was also developed by FVRDE with an eye to possible user preference for a diesel. This applied in particular to forces which were already equipped with American-built armoured vehicles powered by General Motors two-stroke diesels and which might prefer the Scorpion to be powered by a similar engine. Thus the static test rig was used to develop the engine compartment of the Scorpion so that it could take a General Motors 4-53T two-stroke diesel as an alternative to the Jaguar XK. The GM 4-53T is used, among others, in the vehicles of the M113 family and although it would make the Scorpion heavier it would also increase its operating range, which on roads is already in excess of 600 km.

The drive from the engine is transmitted through a centrifugal clutch, which eliminates the need for a clutch pedal, and the TN-15 transmission first tried in the MTR. The TN-15 transmission consists of a semi-automatic hot-shift epicyclic gearbox and provides seven speeds in each direction, as well as regenerative triple-differential steering.

One of the features of the Scorpion engine installation is a novel, mixed flow (part axial, part centrifugal) cooling fan developed by Airscrew Fans Ltd. The fan is driven by a wide toothed belt off the engine to transmission shaft and is relatively quiet, as well as efficient, which makes it particularly suitable for a light tank intended to be used for reconnaissance.

The requirement for relatively silent operation has also led to the adoption of polyurethane elastomer tyres for the track driving sprockets, which reduces metal-to-metal contact in the running gear to that between the sprocket teeth and the track links. Such an arrangement had only been adopted in one or two other vehicles and has helped to make the Scorpion significantly quieter than earlier tracked armoured vehicles.

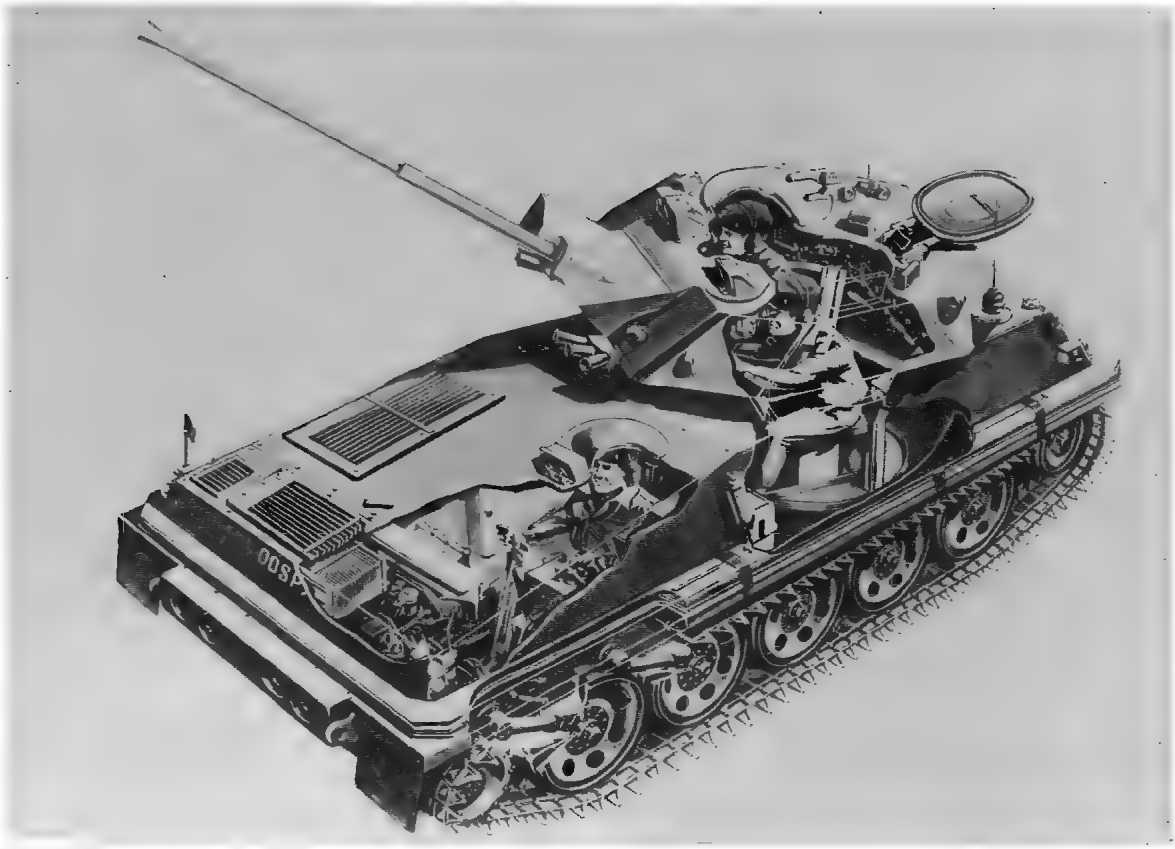
In keeping with current light armoured vehicle practice, the track pins are rubber bushed and the idlers as well as the road wheels are rubber tyred. The track links also have rubber pads on both the road and the road wheel sides. The links themselves, of which there are 79 per track, are of cast steel and of an exceptionally light, skeleton design.

To help keep the weight of the running gear down to a minimum, the road wheels are of aluminium and the trailing arms on which they are mounted are aluminium forgings. For similar reasons track return rollers have been very sensibly dispensed with, the return run of the track resting on tops of road wheels, in spite of the fact that the road wheels have been provided with a generous vertical travel of 0·3 m, from bump to rebound.

ARMAMENT

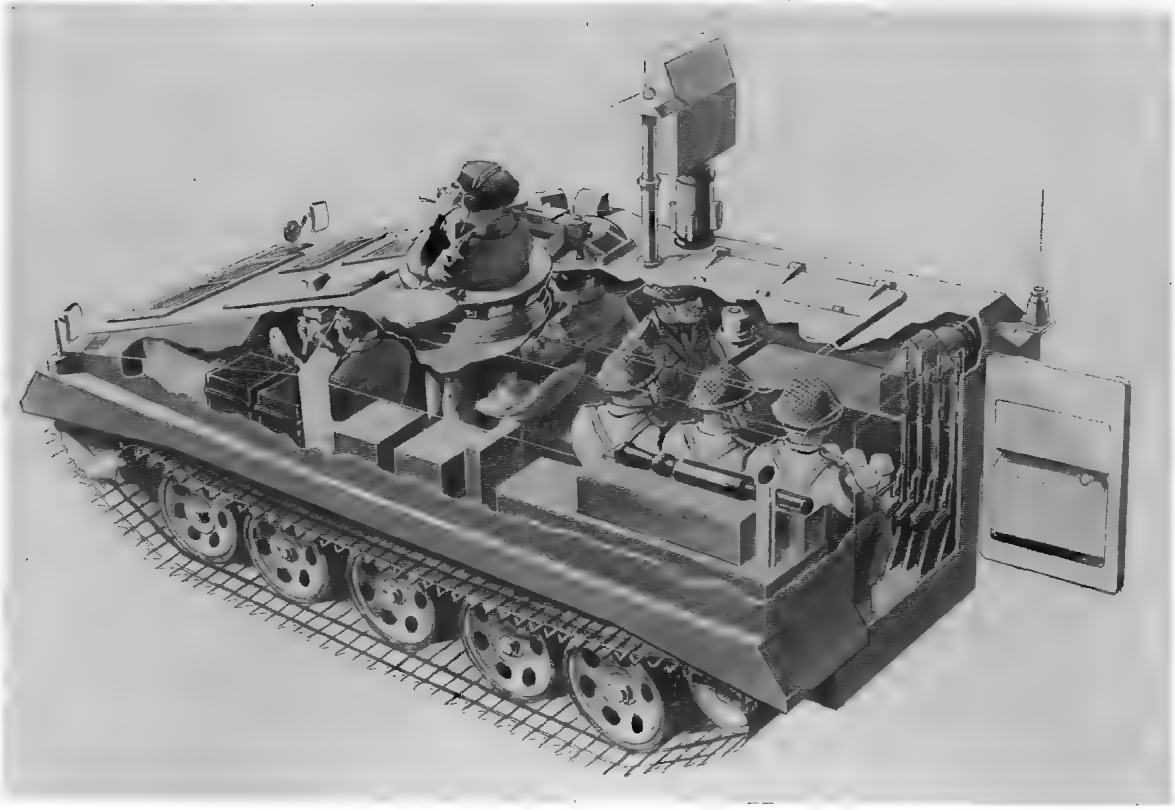
Yet another contribution to the compactness and lightness of the Scorpion was made by locating the engine compartment at the front of the hull, alongside the driver's compartment. The advantages of such an arrangement were first shown by the Vickers-Carden-Loyd light tanks of the early thirties and have been exploited much more recently in the French AMX-13 light tank. In the case of the Scorpion there was, however, another and even more important reason for locating the engine at the front of the hull. This was the requirement that its chassis should serve with a minimum of modification as the basis of an armoured personnel carrier, which had to have its crew compartment at the rear and by the same token required the engine to be placed at the front.

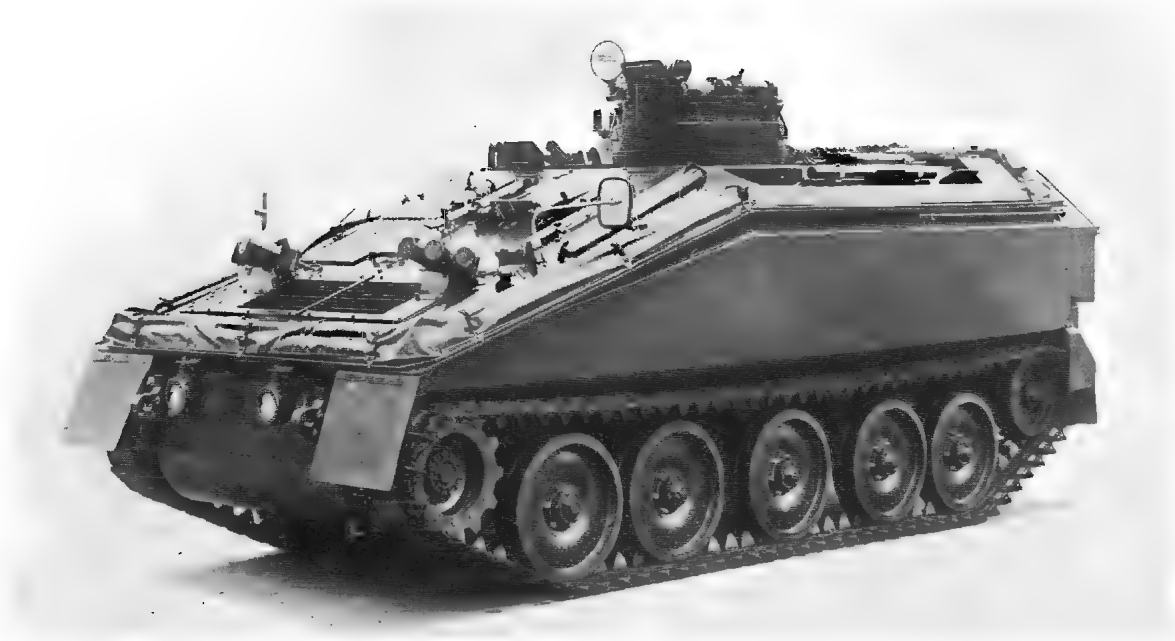
As the engine of the Scorpion had to be located at the front its fighting compartment and turret are at the rear.



Sectioned drawing of a Scimitar reconnaissance vehicle, or FV 107 (Alvis)

Sectioned drawing of a Spartan armoured personnel carrier, or FV 103 (Alvis)





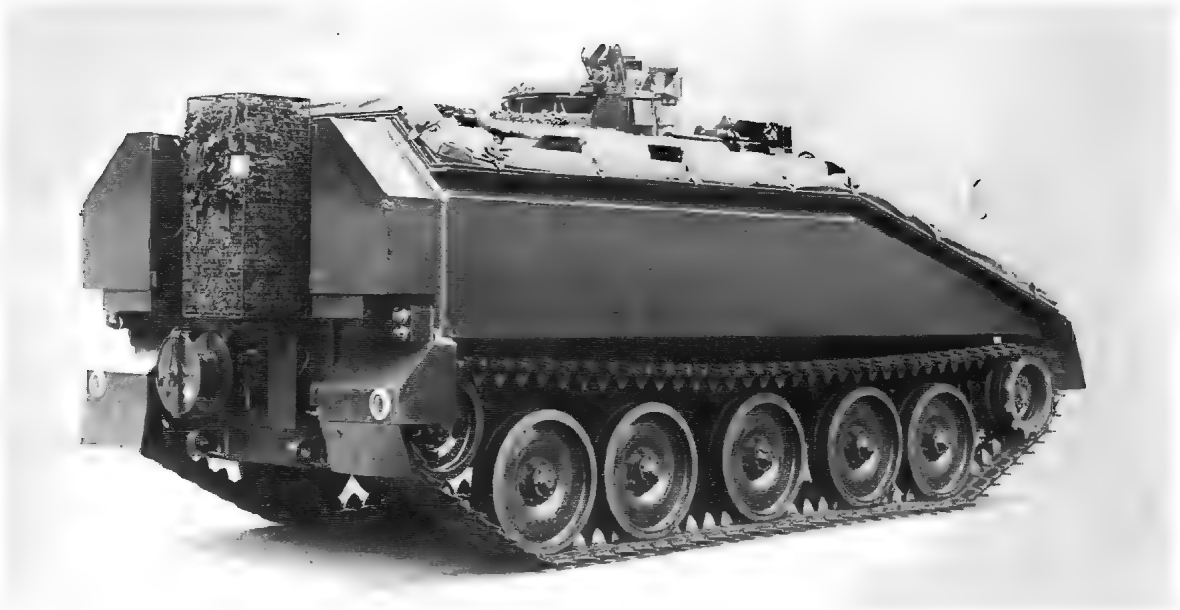
Prototype of the Spartan armoured personnel carrier (Alvis)

The turret has undercut sides which give it a somewhat ungainly appearance but its shape provides a maximum of space for a turret ring diameter of 1·4 m, the same incidentally as that of the Saladin. The turret is occupied by the commander, who sits on the left, and the gunner, and mounts a 76mm gun.

The gun is a lightened version of the 76mm gun successfully used for a number of years in the Saladin armoured car. It is a medium velocity gun which fires high explosive squash head, or HESH, projectiles with a muzzle velocity of 535 m/s. The HESH projectiles are capable of defeating armour of up to medium thickness, which means that the Scorpion can effectively fight all hostile armoured vehicles except for heavily armoured battle tanks and even in their case it has a chance of knocking them from the side. The HESH rounds are also very effective against concrete weapon emplacements and against buildings.

In addition to HESH, the 76mm gun is also provided with more conventional high explosive rounds as well as smoke and canister ammunition. The Scorpion can, therefore, act as a highly effective fire support vehicle for the infantry as well as being able to fight light armoured vehicles. In this respect it is greatly superior to most contemporary armoured reconnaissance vehicles and its main armament is as powerful as that of tanks which in the past would have weighed at least twice as much and were classed as medium tanks.

Side view of the Spartan armoured personnel carrier (Alvis)



Three-quarter rear view of the Spartan armoured personnel carrier (Alvis)

The secondary armament of the Scorpion consists of a coaxial 7·62mm machine gun which, in addition to its usual anti-personnel role, can also be used as a ranging machine gun for the 76mm gun. This results from developments in sighting equipment and increases the chances of a first round hit at longer ranges without bringing in the complexity and vulnerability of a range finder. The use of the 7·62mm machine gun for ranging also offers potential economies in the use of the 76mm gun ammunition, of which 40 rounds can be stowed. This is more than the number of rounds carried in several battle tanks but, nevertheless, the 76mm gun needs to be used effectively if unduly frequent resupply is to be avoided. In addition the Scorpion carries 3,000 rounds of machine gun ammunition and 18 smoke grenades, which are fired from two multi-barrel dischargers mounted on the turret.

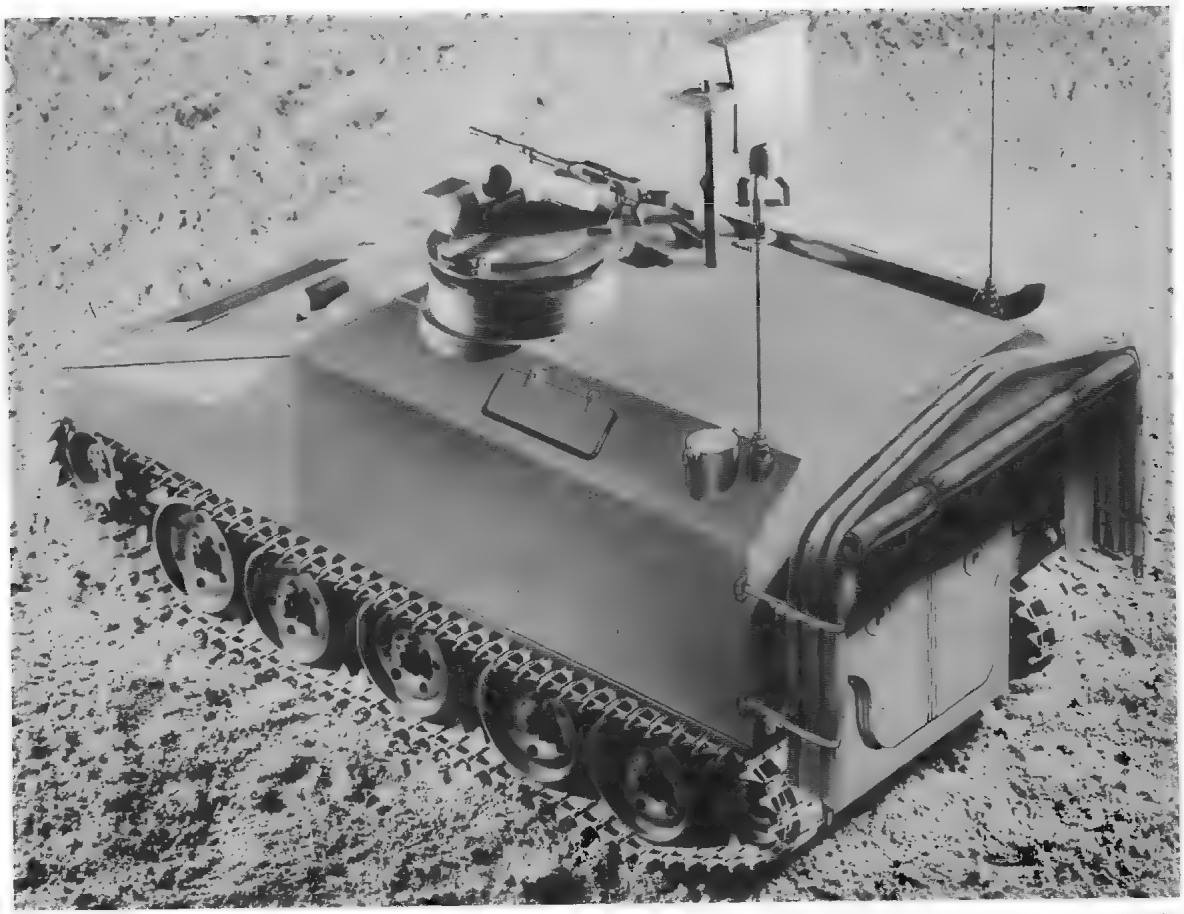
The armament of the Scorpion can be depressed to the normal maximum of 10 degrees and elevated 35 degrees, which is considerably more than in most battle tanks and makes it more flexible. All this is done manually through elevating gears and the turret is also traversed, through 360 degrees, by hand, powered traverse being eschewed for the sake of simplicity and low cost. On the basis of the experience with the Saladin armoured car the task of loading the 76mm gun has been allocated to the commander. This gives the commander more freedom to observe than the alternative arrangement adopted in some two-man turrets where the commander doubles in the role of a gunner while the second man loads the weapons and operates the radio.

Following the latest practice in battle tank surveillance equipment, the commander is provided with a binocular periscope which is capable of 85 degree rotation and can be set to give either unity or tenfold magnification. The gunner has a unity or eightfold magnification binocular daylight sight and can also be provided with a passive night sight. In addition there are seven fixed, unity magnification periscopes around the commander's hatch providing him with all round vision and there are two additional fixed periscopes by the gunner's hatch. All this optical equipment makes for very good vision from within the turret even when closed down. In contrast, the driver is provided with a single periscope but this is of a wide angle type.

STRIKER AND SCIMITAR

For all its virtues, it was never intended that the Scorpion be produced by itself. Clearly its 76mm gun is not powerful enough to fight battle tanks and it needed, therefore, to be supplemented by a missile-armed tank destroyer. This vehicle was designed to use the Swingfire anti-tank guided missile developed by the British Aircraft Corporation and previously considered for the AVR. The Swingfire is a second generation missile which still has a trailing wire link and a manual guidance system. Nevertheless, it has a maximum range of 4,000 metres and is provided with an autopilot and an automatic gathering facility which overcomes some of the shortcomings of missiles with earlier manual control systems. It also has a powerful, large-diameter shaped-charge warhead which enables it to perforate the thickest tank armour.

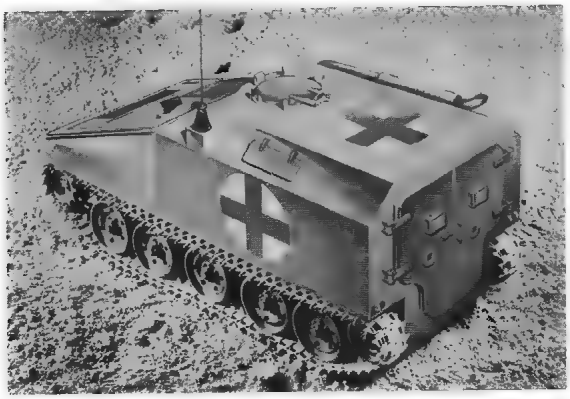
An early design of the missile vehicle incorporated a turret similar to that developed for F.V.712, the big-wheel Ferret Mark 5 scout car. This is a one-man turret which mounts two ready-to-fire Swingfire missiles on either side and a 7·62mm machine gun in the frontal plate. When the turret was mounted on the Scorpion hull four additional missiles were to be stowed internally. However, as the Swingfire does not have to be launched pointing exactly in the direction of the target the idea of using a turret was abandoned subsequently. Instead, the missile vehicle, which was called the Striker, has taken the form of a 3-man carrier with a simple missile container-cum-launcher above the rear portion of the hull. The launcher is elevated for firing and holds five ready-to-fire Swingfire missiles; five additional missiles are stowed in the hull.



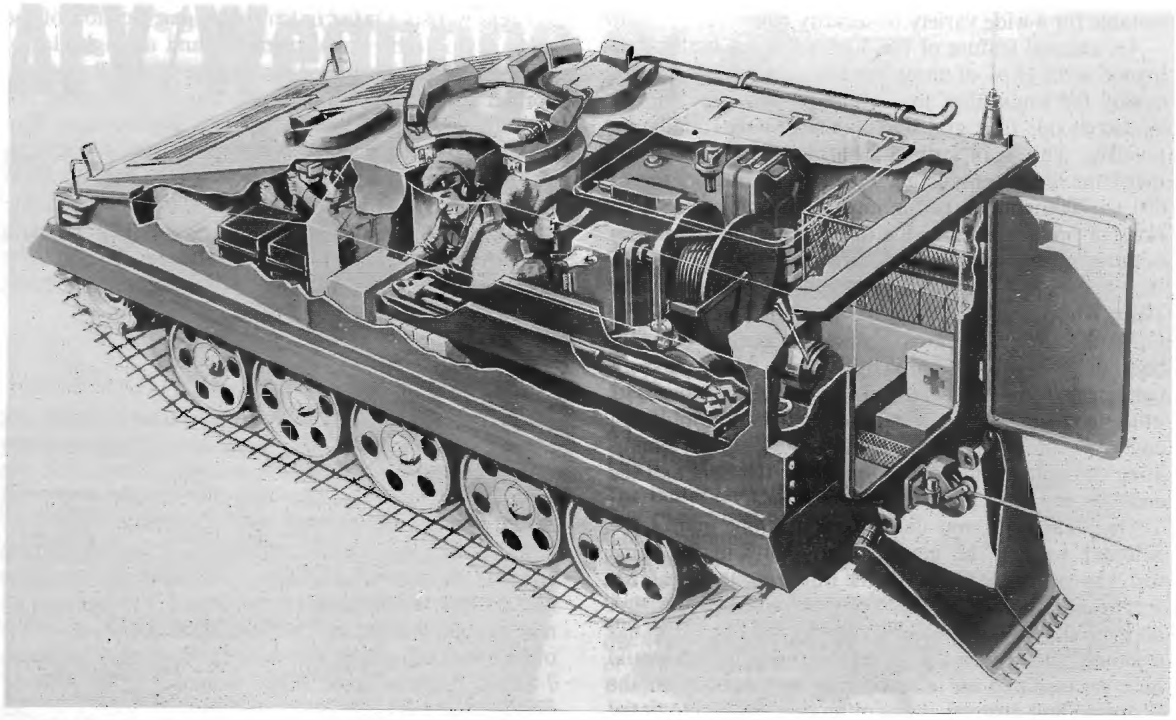
Small-scale model of the Sultan armoured command vehicle, or FV 105 (Alvis)

Another turreted vehicle was, however, developed. The reason for this was that the Scorpion and the Striker were intended primarily for armoured reconnaissance regiments and that a somewhat different vehicle was required for the reconnaissance units of tank regiments and mechanized infantry battalions. These already had powerful anti-tank and fire support weapons and any light armoured vehicle for their reconnaissance troops or platoons needed to be armed principally to deal with hostile armoured personnel carriers and other light armoured vehicles. A decision was therefore taken to develop a CVR(T) similar to the Scorpion but armed with a high velocity 30mm gun instead of the medium velocity 76mm gun.

Small-scale model of the Samaritan armoured ambulance, or FV 104 (Alvis)



The vehicle became known as the Scimitar and the gun with which it was armed was the 30mm Rarden. This gun was developed specially for installation in light armoured vehicles by the Royal Armament Research and Development Establishment and the Royal Small Arms Factory, Enfield, from whose combined initials its name was derived. Its calibre is larger than that of automatic cannon mounted previously in light armoured vehicles although it has been common for guns of fighter aircraft ever since it was adopted for German fighter cannon towards the end of the Second World War. The adoption of the 30mm calibre for the Rarden was, however, more immediately related to the development, in Switzerland, of the high-velocity Hispano-Suiza 30mm HS 831 L anti-aircraft gun. The Rarden has been designed, in fact, to fire the same ammunition as the Hispano-Suiza gun. But in addition a very effective armour-piercing discarding sabot, or APDS, round was developed for it in Britain. This is similar to the highly successful APDS ammunition of battle tank guns and has a muzzle velocity of more than 1,200 m/s, which makes the 30mm Rarden capable of defeating the armour of all vehicles, except for the frontal armour of battle tanks. In particular, it can defeat the armour of all armoured personnel carriers and other light armoured vehicles at ranges of 1000 metres, or more. At the same time its ability to fire light but effective high explosive shells, coupled with the coaxial 7·62mm machine gun, makes the Scimitar



Sectioned drawing of the Samson recovery vehicle showing its winch and ground anchor spades in working position (Alvis)

Small-scale model of the Samson armoured recovery vehicle, or FV 106 (Alvis)

suitable for a wide variety of security roles.

An unusual feature of the 30mm Rarden is that it is loaded with clips of three rounds and designed principally for single shot fire, although two clips can be loaded at one time and bursts of up to six rounds are possible. This is in striking contrast to other, belt or magazine fed automatic guns with cyclic rates of fire of 600 to 1000 rounds per minute. However, these high rates of fire are of no value in light armoured vehicles because of the very limited numbers of rounds which they can carry. On the other hand, the design of the 30mm Rarden as, at most, a short burst gun made it possible to keep it relatively simple, accurate, compact and light. Thus its weight is only 90 kg, which makes it comparable with guns of much smaller calibre. One of its other features which is worth noting is that empty shell cases are automatically ejected out of the turret, eliminating the usual clutter of the crew compartment and the emission into it of noxious powder fumes.

The 30mm gun and the coaxial machine gun of the Scimitar were to be mounted originally in the same turret as that of the CVR(W), the Fox armoured car. This was attractive from the point of view of standardization between the two families of CVRs but the Fox turret has a somewhat smaller, 1·27 m ring diameter which would have necessitated an adaptor ring to mount it on the Scorpion hull. Instead, it was ultimately decided to fit the Scimitar with the same turret as the Scorpion but with a mantlet modified to take the 30mm gun.

SPARTAN

While the Scorpion, Striker and Scimitar satisfy the primary needs of different reconnaissance units they leave unfulfilled their need for a complementary vehicle which would carry riflemen or assault pioneers for dismounted action. This need was, however, recognised from the beginning of the CVR(T) development and a light armoured personnel carrier was designed in parallel with the Scorpion. The two used the same automotive components and the design of the Scorpion was constrained to some extent by the requirement that its chassis should also be used for an armoured personnel carrier, as already indicated in connection with the decision concerning the location of the engine compartment.

The carrier has been called the Spartan and externally it differs from the Scorpion in having a higher hull with a more steeply sloping front and no turret. Its height, to the top of the roof, is however still only 1·7 m and its overall length 4·8 m, while its overall width of 2·2 m is the same as that of the Scorpion. Within these modest dimensions sufficient room has been provided for seven men, who can form an effective team for dismounted action and yet leave the vehicle adequately manned.

The total of seven men is made up of the vehicle commander, gunner, driver and four riflemen. The gunner mans a No. 16 rotating cupola, which mounts a 7·62mm machine gun fired by remote control from within, and would normally stay with the driver in the vehicle while the other crew members dismount. Alongside the cupola is a hatch and periscopes for the commander who does not, therefore, have to act as a machine gunner in addition to performing his proper role, as commanders are expected to do in a number of earlier armoured personnel carriers.

There is also a large hatch in the rear portion of the roof for the other crew members and a single, large, 0·86 m × 1·0 m side hinged door in the rear hull plate for normal access to the crew compartment. Fully laden the Spartan weighs 8·17 tonnes, which is slightly more than the Scorpion but its performance is virtually the same and it can also swim with the aid of a collapsible flotation screen. On the other hand it differs more from the Scorpion than the Scimitar, for instance. It is appropriate therefore that the Spartan should have been the first to be built after the Scorpion, its first prototype being completed by Alvis in March 1971.

SULTAN, SAMARITAN AND SAMSON

The development of the Spartan armoured personnel carrier has also provided a ready made basis for three complementary or auxiliary vehicles. They are the Sultan command vehicle, the Samaritan armoured ambulance and the Samson recovery vehicle.

The Sultan and the Samaritan differ from the Spartan in having a higher hull, larger rear doors and no large roof hatch over the crew compartment. There is also no machine gun cupola on the Samaritan. Samson, on the other hand, has a large roof hatch and a simply mounted 7·62mm machine gun. What is more, to be able to recover other vehicles, it has two ground anchor spades pivoted on the rear hull plate and a winch.

Thus, the Scorpion and the other six vehicles related to it form a self-sufficient family of light armoured vehicles which by themselves can fulfill all the requirements of armoured units intended for reconnaissance, counter-reconnaissance and a variety of security roles.

SUMMARY OF THE LEADING CHARACTERISTICS OF SCORPION CVR(T)

Gun, calibre	76mm
ammunition	40 rounds
Machine gun, coaxial	7·62mm
Weight, net	6800 kg
combat loaded	7940 kg
Length, overall (gun forward)	4·36 m
Width, overall	2·18 m
Height, to turret roof	1·92 m
overall, to top of periscopes	2·10 m
Ground clearance	0·36 m
Width of tracks	0·43 m
Ground pressure	0·35 kg/cm²
Engine, make and model	Jaguar XK
gross horse power	195
Maximum road speed	80 km/hr
Range, on roads	more than 600 km
Crew	3

ACKNOWLEDGEMENTS

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Included in this Profile are the Pbv 302 armoured personnel carrier and its derivatives—the Bgbv 82 recovery vehicle, the ingenious Brobv 941 bridgelayer and the IKV 91 infantry gun intended for operation in the north of Sweden, the Norrland: BY R. M. OGORKIEWICZ, author of *Design and Development of Fighting Vehicles* and *Armoured Forces*, and of *AFV/Weapons Profiles 28, 34 and 39.*

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While the Panther and Tiger have tended to capture the limelight, it was in fact the PanzerKampfwagen III and IV which established the reputation of the German armoured forces. The Panzer IV, whose first prototype was built in 1934, eventually became the only German tank which remained in production and troop service throughout World War II, a fact which demonstrates its sound basic design and the brilliant foresight shown in its specification. It was still in service in the Syrian as late as 1967.

44 Ferrets and Fox

45 Vickers 37-ton Main Battle Tank ("Vijayanta")

46 Light Tanks M22 (Locust) and M24 (Chaffee)

48 T-34

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